Non-Tidal Raritan River TMDL Study

Presented to:

Raritan River Stakeholders

June 5, 2013

Today's Agenda:

- Past Meeting Review
- Purpose of the Study
- Basin Overview
- Monitoring and Modeling
- TMDL Critical Endpoints
- Draft TMDL Outcome
- Next Steps and Schedule
- Discussion

Past Stakeholder Meeting Review

June 2, 2004	Discharger Monitoring Request and Meeting
Aug 17, 2004	Scope of Work Meeting Presented
June 22, 2005	Presentation on Sampling Approach & Progress
Aug 20, 2007	Comprehensive Data and Preliminary Assessment
Sept 17, 2007	Model Calibration and Validation Presentation
Dec 17, 2007	Water Quality Targets & Future Simulations
May 7, 2008	Limits to Address DO and pH Water Quality Targets
Oct 9, 2008	Status Update on Raritan TMDL
Mar 25, 2009	Status Update on Raritan TMDL
June 16, 2011	Raritan TMDL Implement at 3rd Annual Sustainable Raritan River Conference

Purpose of the Study

- Provide the scientific basis to achieve SWQS criteria in Raritan Basin
- Calculate load reductions needed; express as Total Maximum Daily Loads (TMDLs)
- Achieve environmental benefits by implementing the load reductions

Surface Water Quality Standards

Dissolved Oxygen (DO):

- 4 mg/l for Non-Trout (NT) Waters
- 5 mg/l for Trout Maintenance (TM) Waters
- 7 mg/l for Trout Production (TP) Waters

pH :

- 6.5 minimum to 8.5 maximum (s.u.)

Total Phosphorus (TP):

- Lake: 0.05 mg/l TP or Natural Conditions
- Stream: 0.1 mg/l TP, unless narrative criteria are met for designated uses

Total Suspended Solids (TSS):

- 40 mg/l Non-Trout (NT)
- 25 mg/l Trout Maintenance and Production (TM & TP)

What is a TMDL?

A TMDL is the amount of pollutant that a waterbody can assimilate without violating surface water quality standards (load capacity).

$$TMDL = \sum WLA + \sum LA + MOS\ (+ RC)$$

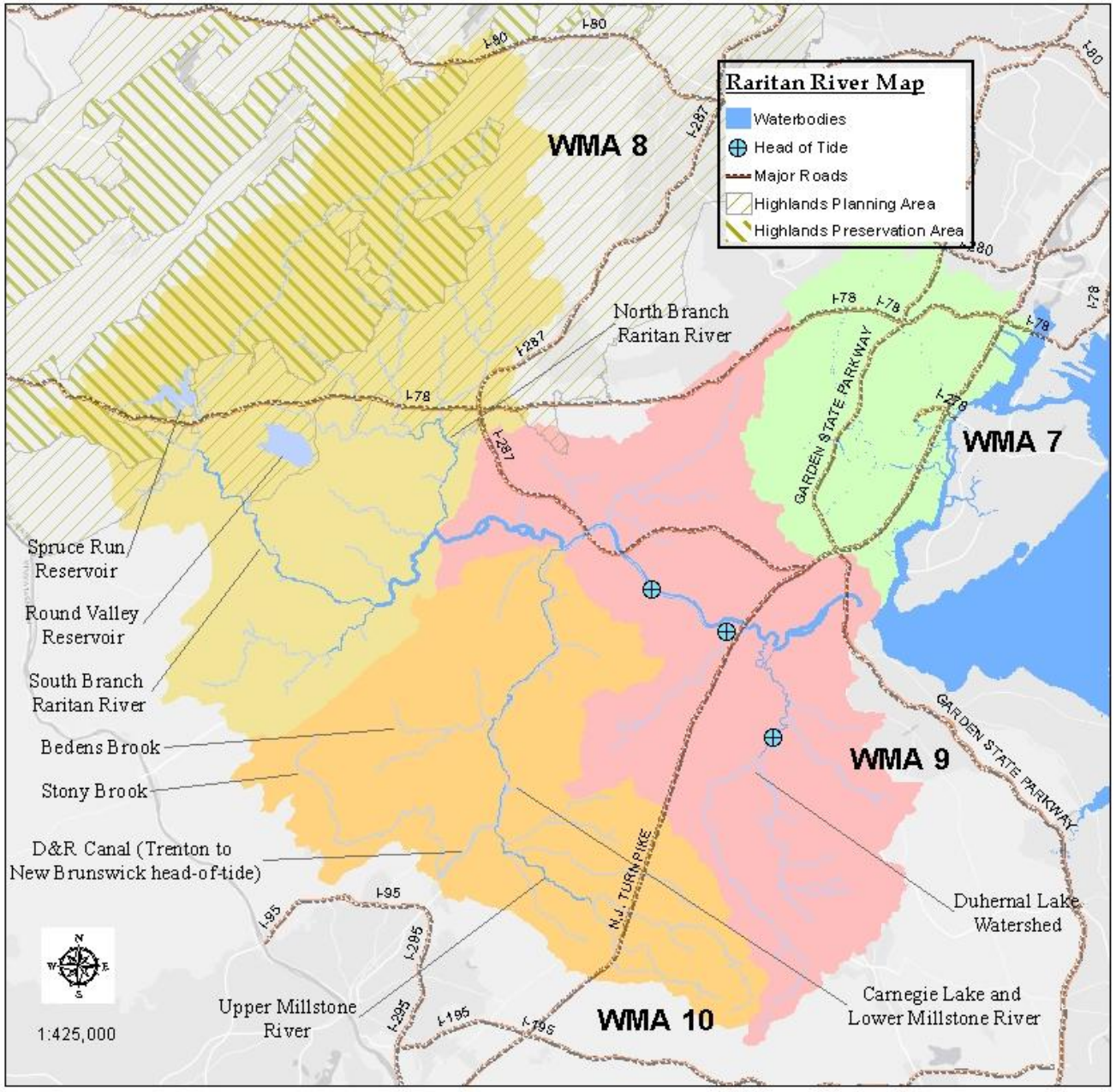
WLA = Wasteload Allocation, assigned to NPDES regulated sources (wastewater, stormwater, CSOs)

LA = Load Allocation, assigned to nonpoint sources (non-regulated stormwater, agriculture, air deposition)

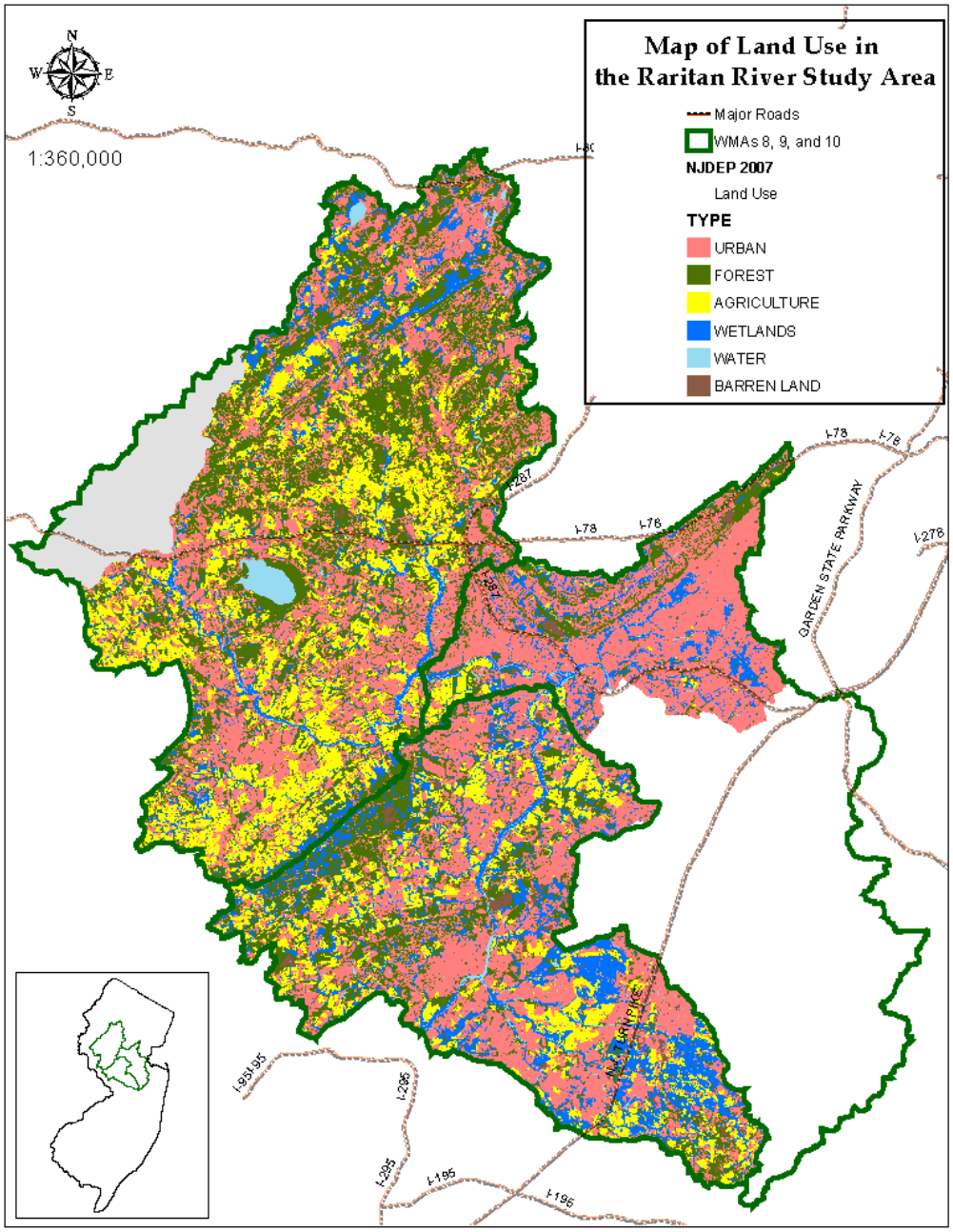
MOS = Margin of Safety

RC = Reserve Capacity, an optional component that allows for future growth

Raritan Area Overview



- Non-tidal Raritan River
- 3 Watershed Management Areas
- 7 Counties
- 80 Municipalities
- Reservoirs and water supply features.
- Highlands Areas



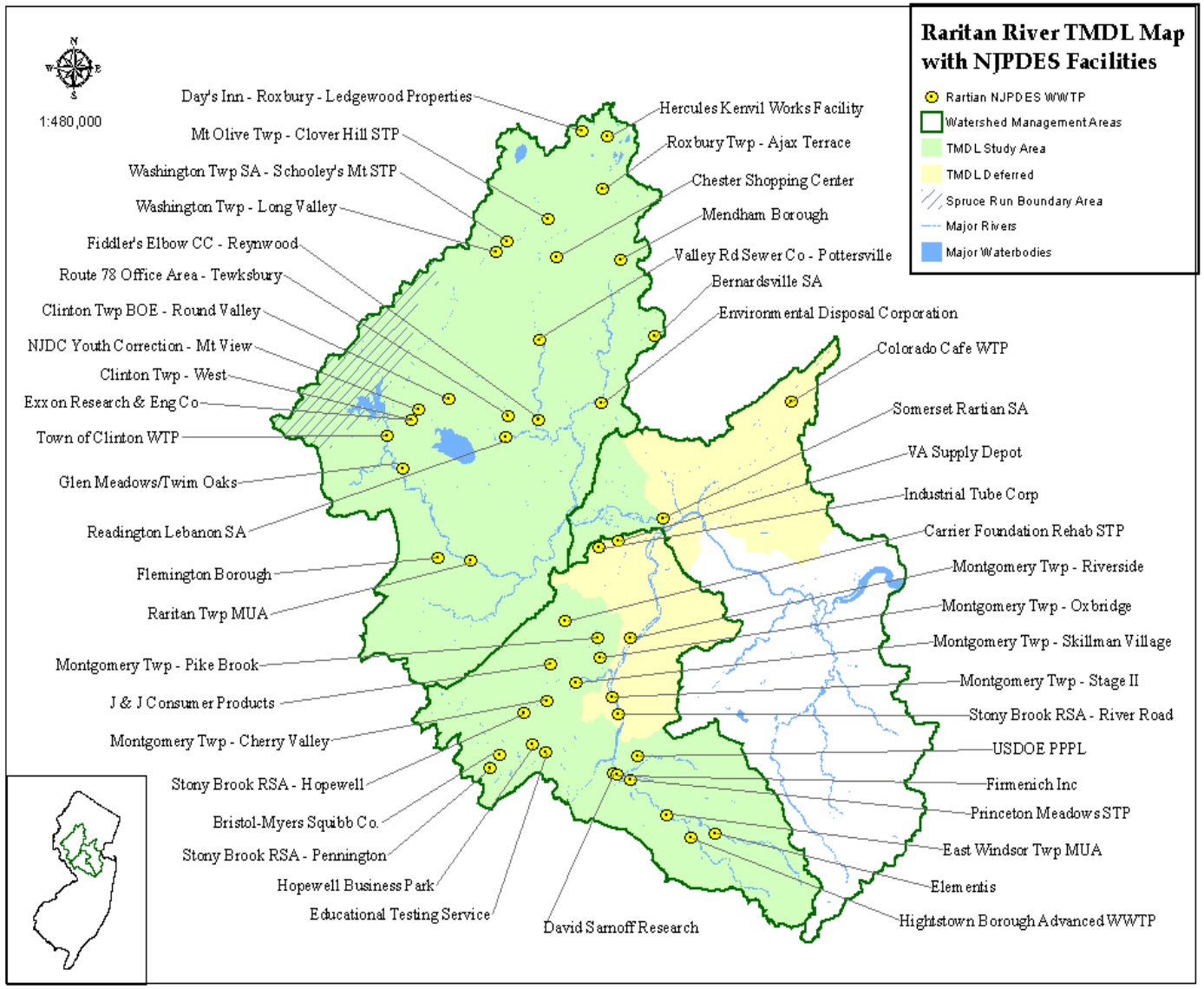
Land Use Distribution

- Study Area

Urban	~ 40 %
Forest	~ 28 %
Agriculture	~ 18 %
Wetlands	~ 12 %
Water	~ 2 %

- Agriculture and Forest are more prevalent in northern areas
- Wetlands is more prevalent in the southern areas
- Development increases toward lower parts of the basin

Point Sources

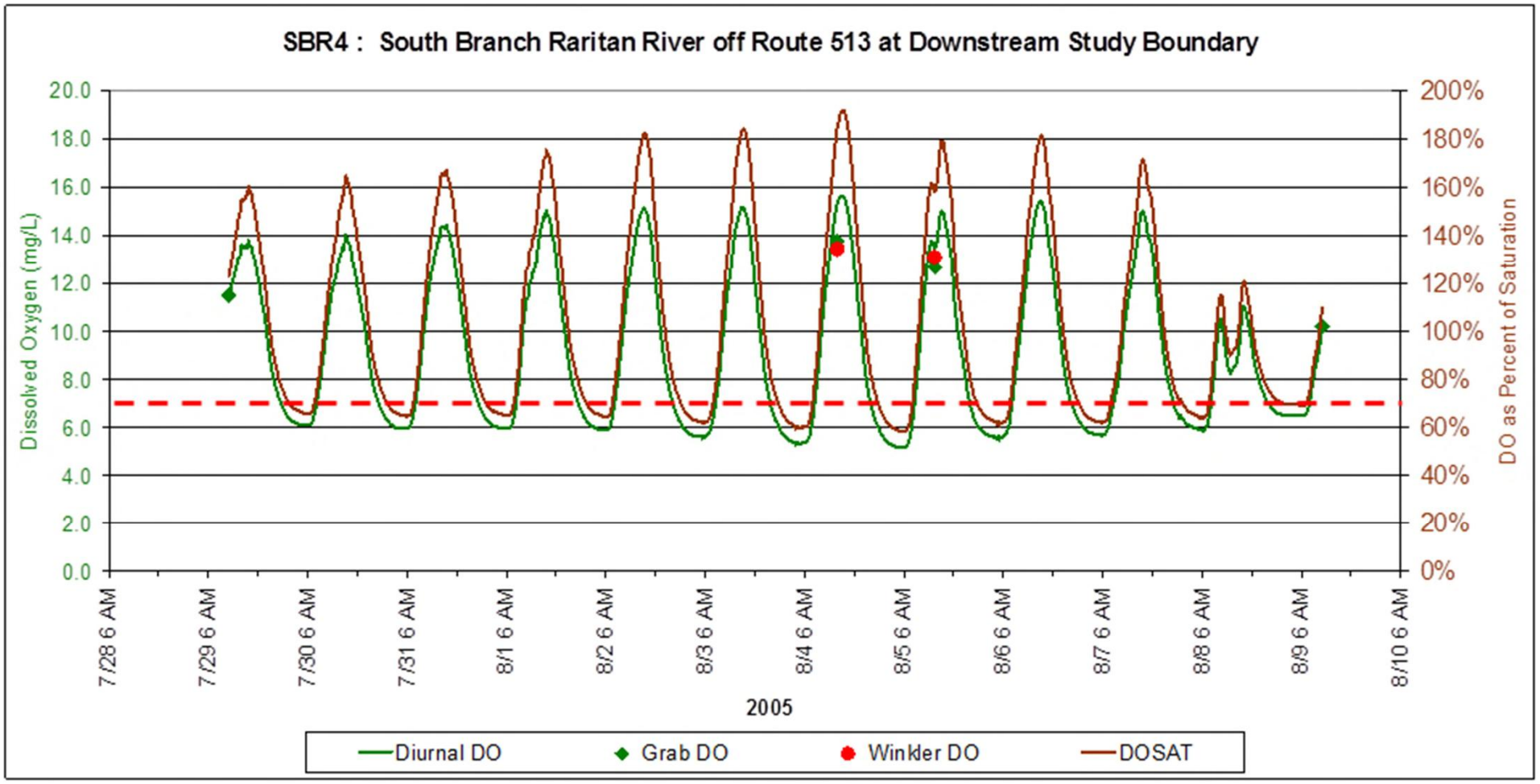


- 47 current NJPDES Waste Water Treatment Plants (WWTPs)
- 33 of 40 WWTPs covered have TP limits pending the TMDL outcome
- 20 WWTP outfalls located either in or above Category 1 waters

Data Collection

- Intensive sampling in 2004 and 2005
  - 3 Low-flow Events (2 days each) @ 77 stations (incl. 12 STPs)
  - 3 High-flow Events (2 days each) @ 69 stations (incl. 13 STPs)
  - 8 Ambient Events @ 41 stations
  - 3 Diurnal Events @ 41 stations
  - 3 Stormwater Events @ 6 stations
- Parameters
  - pH, temperature, DO, alkalinity, $CBOD_5$, P-series, N-series, iron, TDS, TSS, TOC, turbidity
  - Flow at stations, diversions, and WWTPs
- Additional Data
  - Stream cross sections, SOD measurements, diurnal solar radiation (light intensity), underwater light extinction

Typical Diurnal DO Monitoring Results



DO Criterion = 7 mg/l Minimum (Trout Production Stream)

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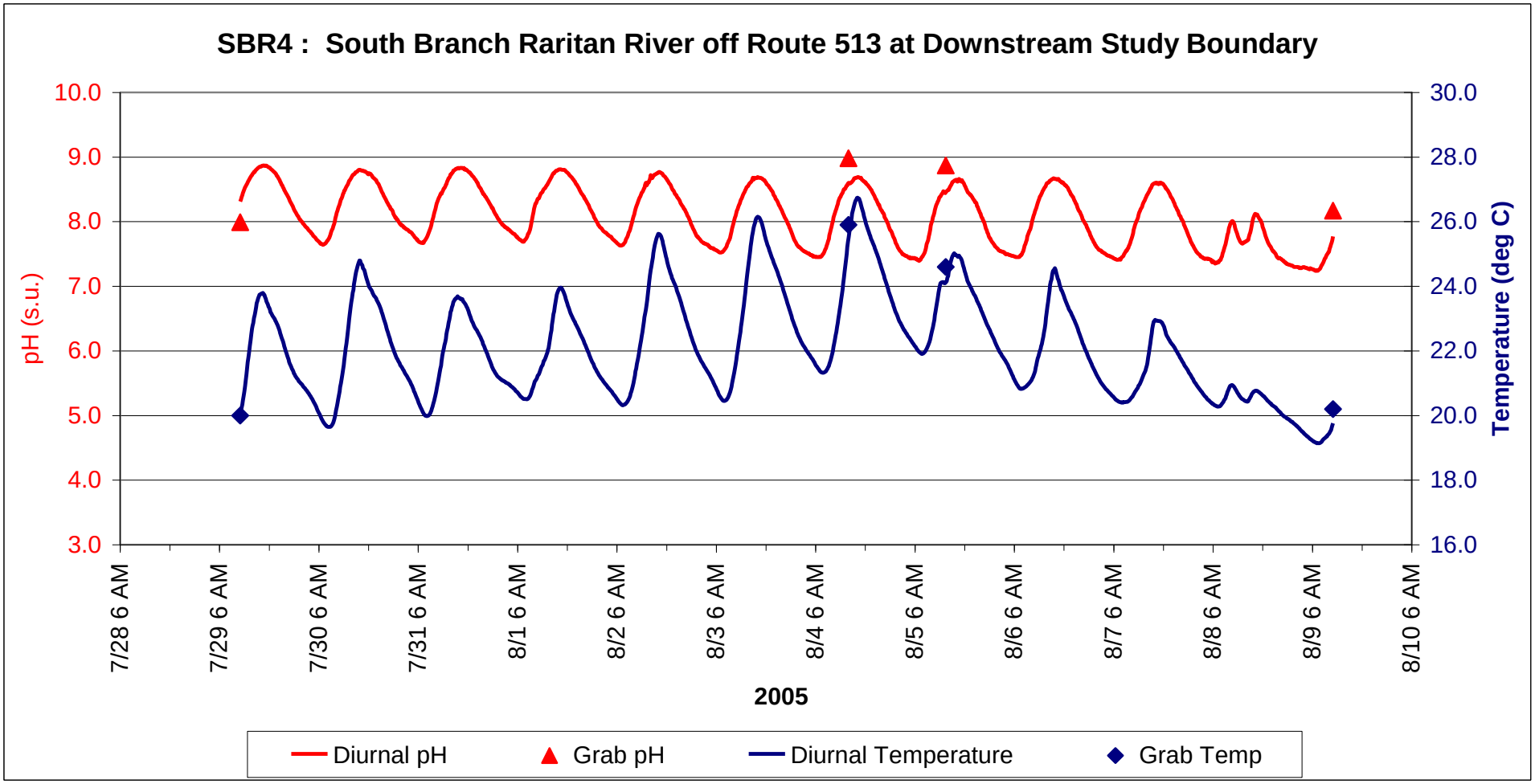
Typical Diurnal pH Monitoring Results



pH Criterion = 8.5 s.u. Maximum

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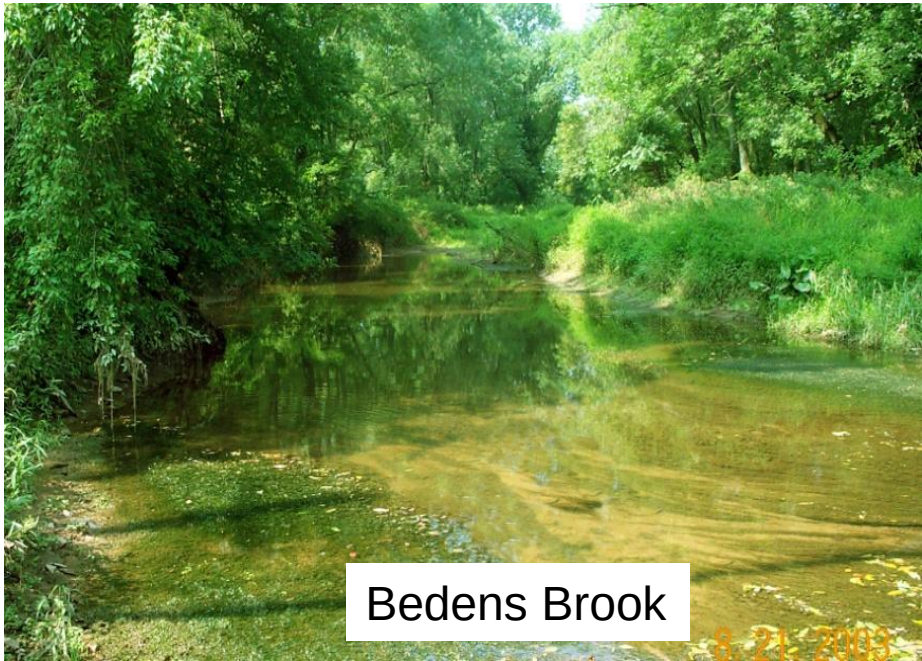
General Raritan Subbasin Observations

- North and South Branch Raritan River
  - Macrophytes, diurnal DO and pH swings
  - Solitude, Ravine, Cushetunk Lakes
- Upper Millstone River
  - Diurnal DO swings
  - Small eutrophic lakes, Carnegie Lake
- Stony Brook
  - Diurnal DO swings
  - Carnegie Lake input
  - Losing stream at low flow
- Bedens Brook
  - Diurnal DO swings
- Lower Millstone and Mainstem Raritan River
  - Diurnal DO and pH swings below Millstone/Raritan confluence

Periods of Eutrophication

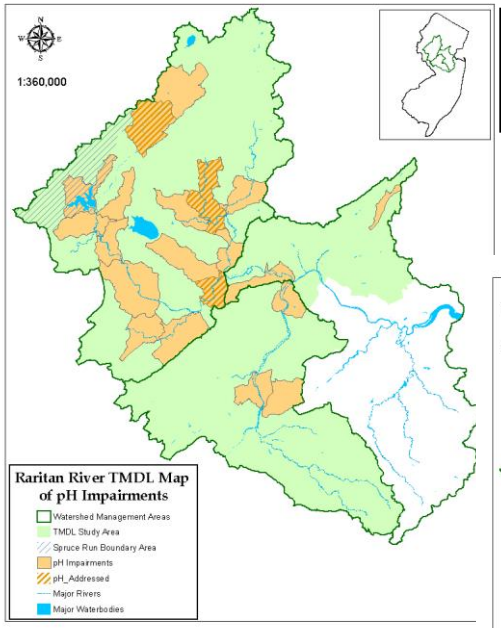
Photos - Kleinfelder/Omni



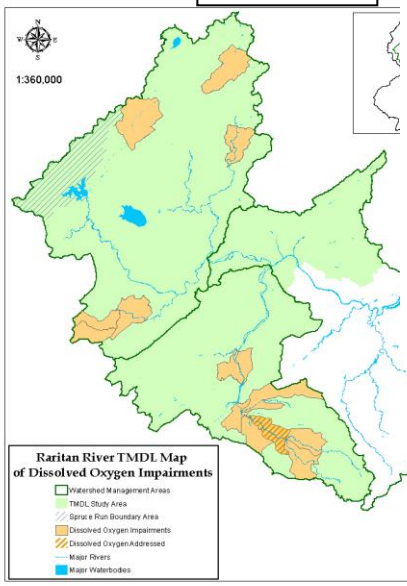
Water Quality Impairments

- 52 water quality impairment listings
  - 33 Total Phosphorus (TP)
  - 3 pH
  - 15 Total Suspended Solids (TSS)
  - 1 Dissolved Oxygen (DO)

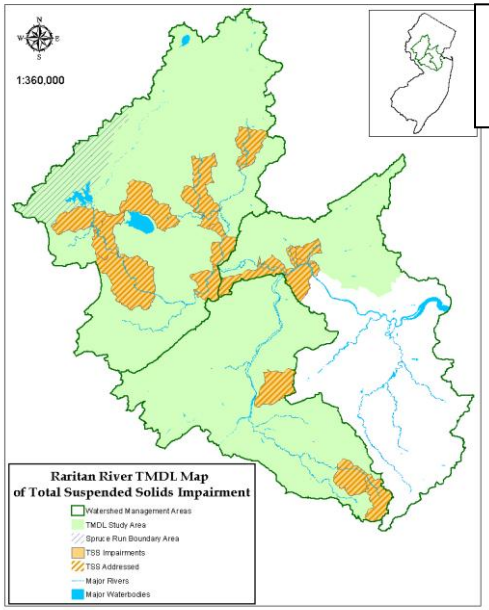
pH



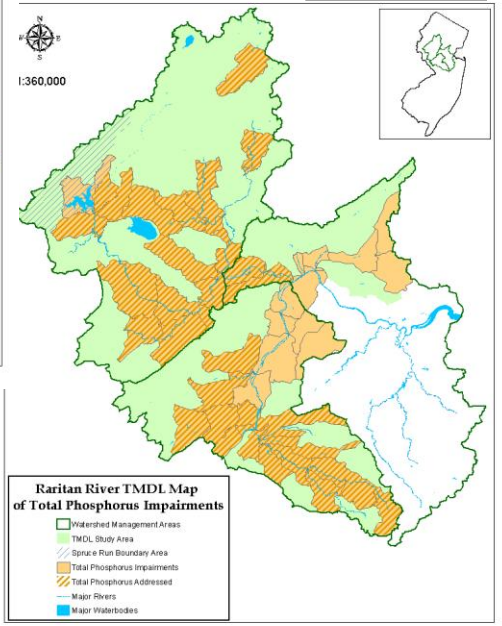
DO



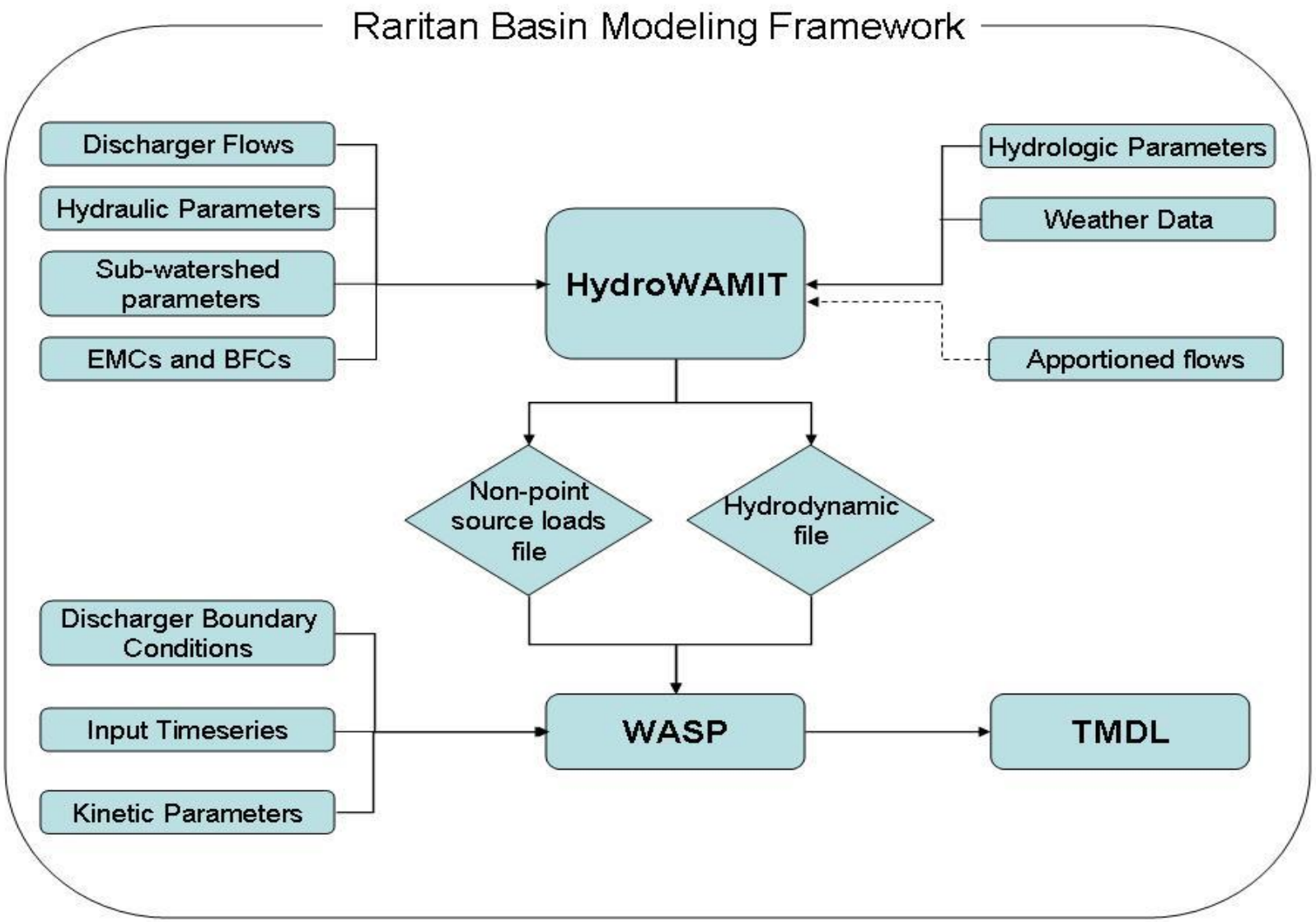
TSS



TP



Modeling Framework



Kleinfelder/Omni

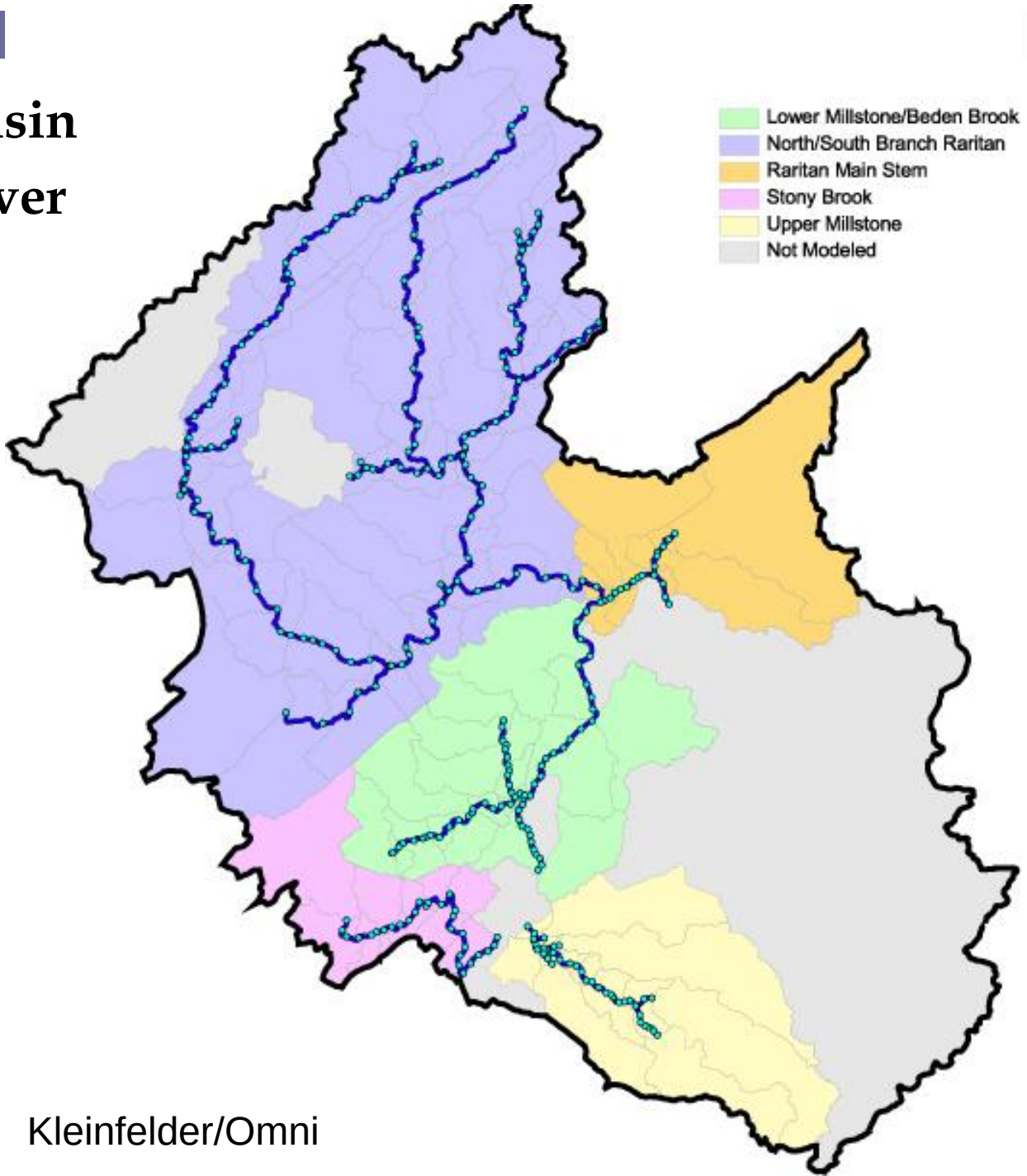
5 Modeled Subbasin of the Raritan River

17 continuous streamflow gauges drive the flow model

Temporal Extent (2002 to 2005) covered wet, average, and drought conditions

Calibration Data - Kleinfelder/Omni data collected in 2004 and 2005

Validation Data- Kleinfelder/Omni, NJDEP, USGS, additional data sources



Kleinfelder/Omni

Innovations in this Study

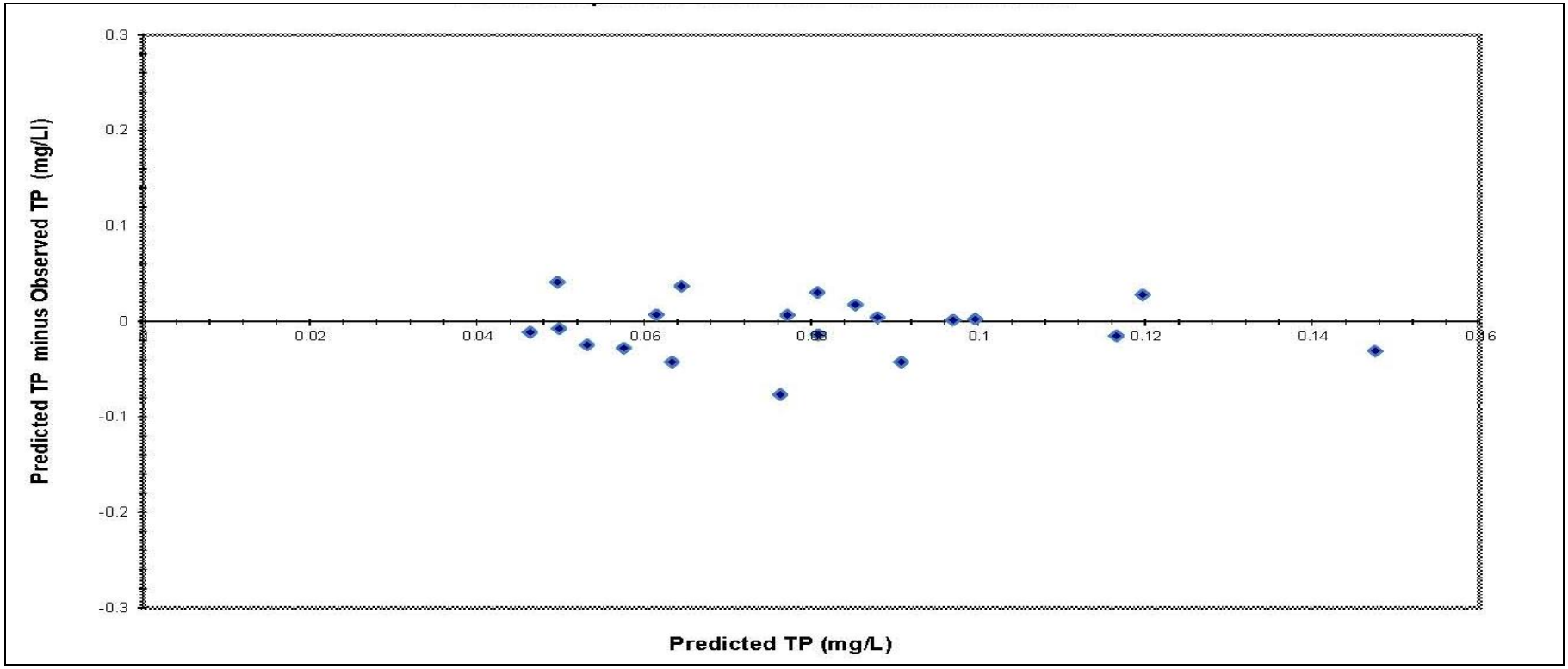
- New module addressing "luxury uptake" was created by WASP author (USEPA) for this project
- Used the relationship between DO peaks and pH peaks to address pH impairments (as pH is not directly simulated in WASP)
  - Diurnal pH peaks were successfully correlated with diurnal DO peaks in some locations
  - Identified three locations where a site specific relationship allowed calculation of a TMDL for TP to resolve pH impairment due to excessive productivity
- Developed a relationship that allowed prediction of the base flow concentration improvement in watershed contributions resulting from implementing NPS controls

Confidence in the Modeling Tool

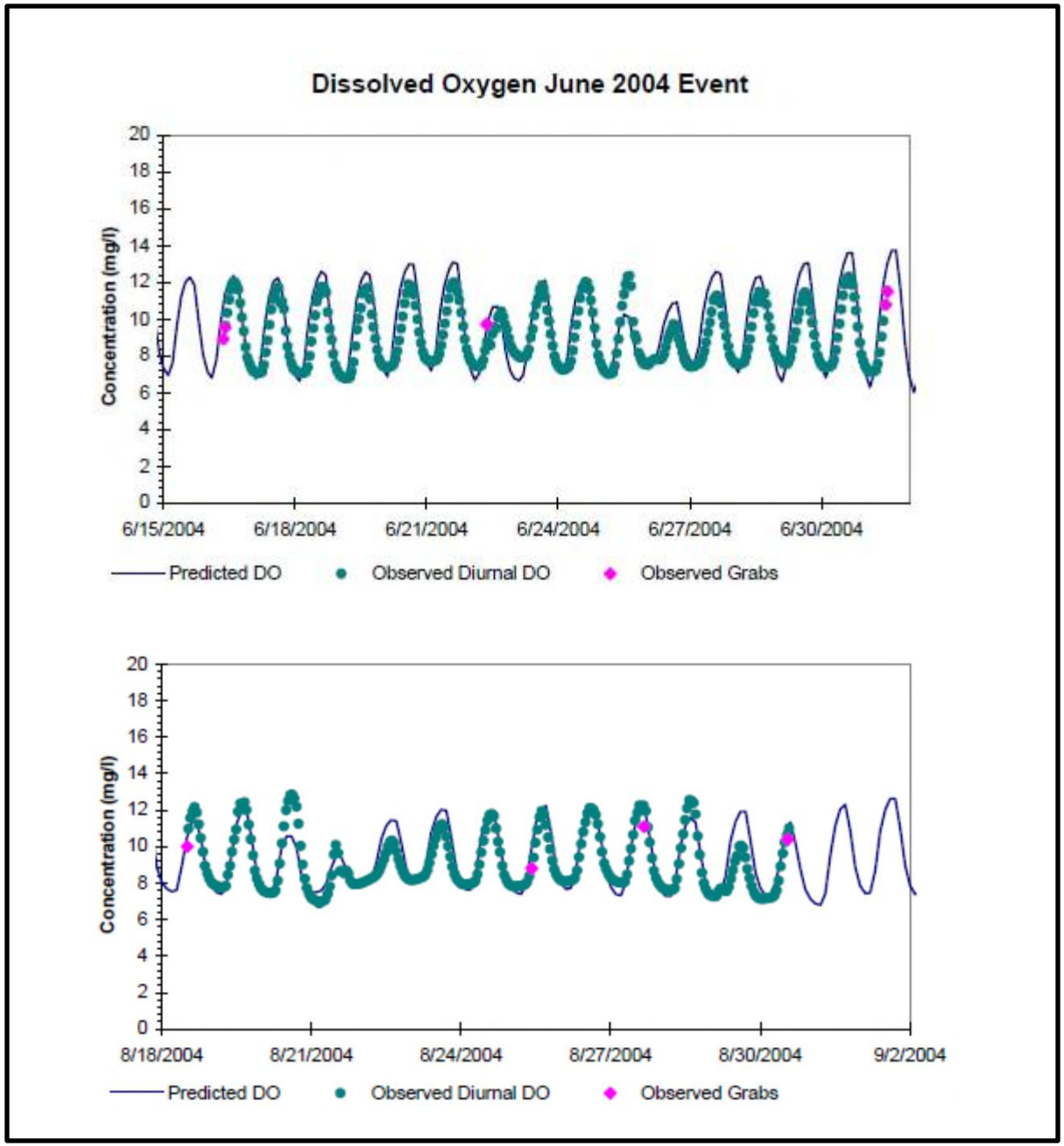
- Subject to various methods (statistical tests) to evaluate the goodness of fit.
- Academic peer review panel found the model suitable to address nutrient impairment in the Raritan River

Example of Grab Sample Calibration

TP Residual vs. Predicted TP Conc.



Example Diurnal DO Calibration



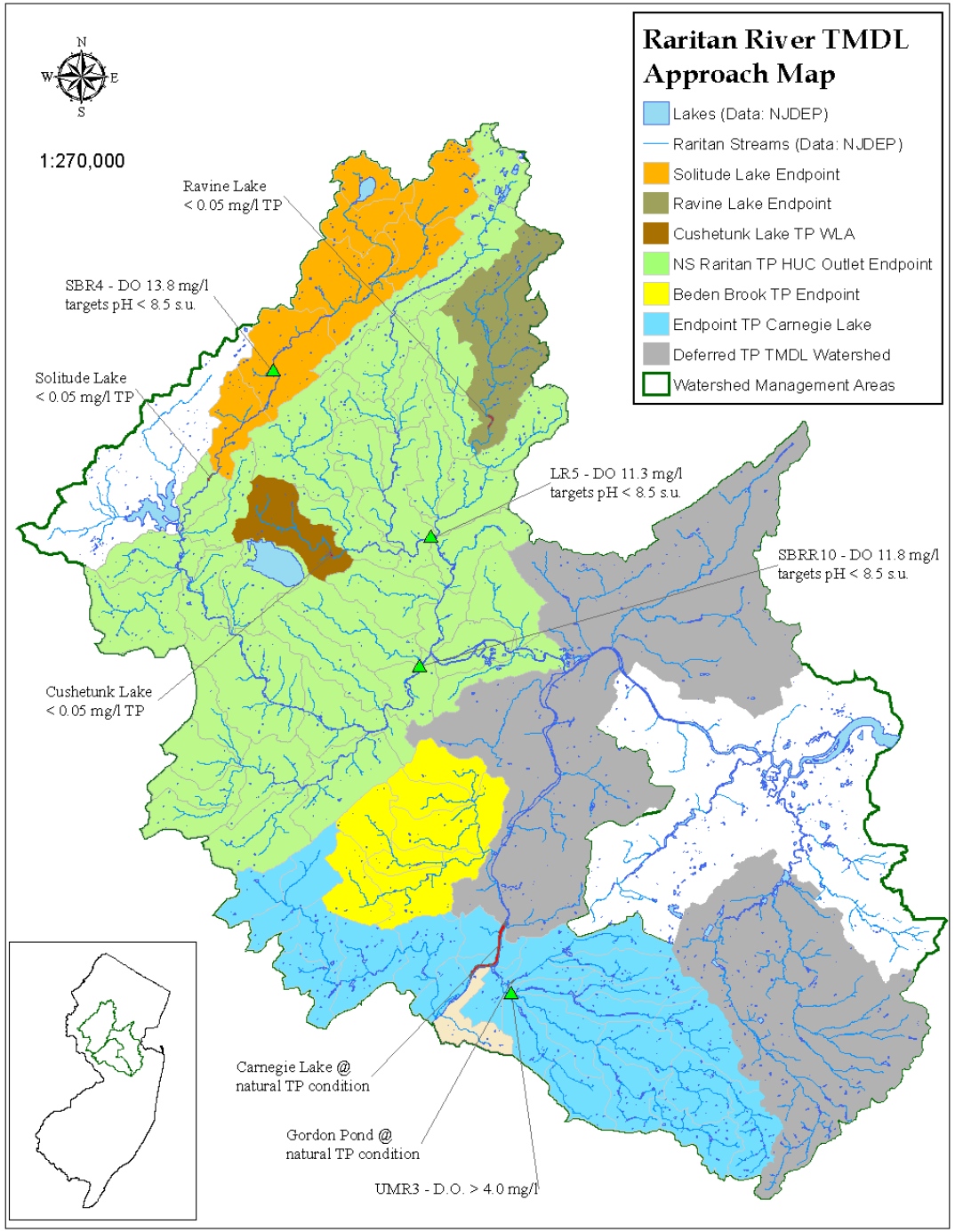
Kleinfelder/Omni

TMDL Simulation

- Constant permitted flow and concentration inputs were used for WWTP discharges
- Margin of Safety
  - 10% simulated point source load
  - 20% simulated non-point source load
- Reserve capacity being included for each sub-basin, no less than 5% of the WWTP allocation
- The TMDL run assures water quality will be at high and low flow conditions

TMDL Critical Endpoints

- Three locations where a DO-pH site specific relationship allowed calculation of a TMDL for TP to resolve pH impairment due to excessive eutrophication
- DO condition at UMR3 to be resolved by pending WWTP ammonia limitation
- HUC outlets at 0.1 mg/l TP
- Lakes at 0.05 mg/l TP or natural conditions



Draft TMDL Outcome

North/South Branch Raritan

- 60 to 80% NPS reduction
- Where possible as determined by TMDL endpoint, seasonal WWTP WLAs are based on summer/winter 7Q10 flows
- WWTP ortho-phosphorus is important to control DO/pH in some reaches
- The WWTP model inputs under the TMDL condition range from 0.13 to 2.5 mg/l TP

Draft TMDL Outcome

Carnegie Lake Watershed

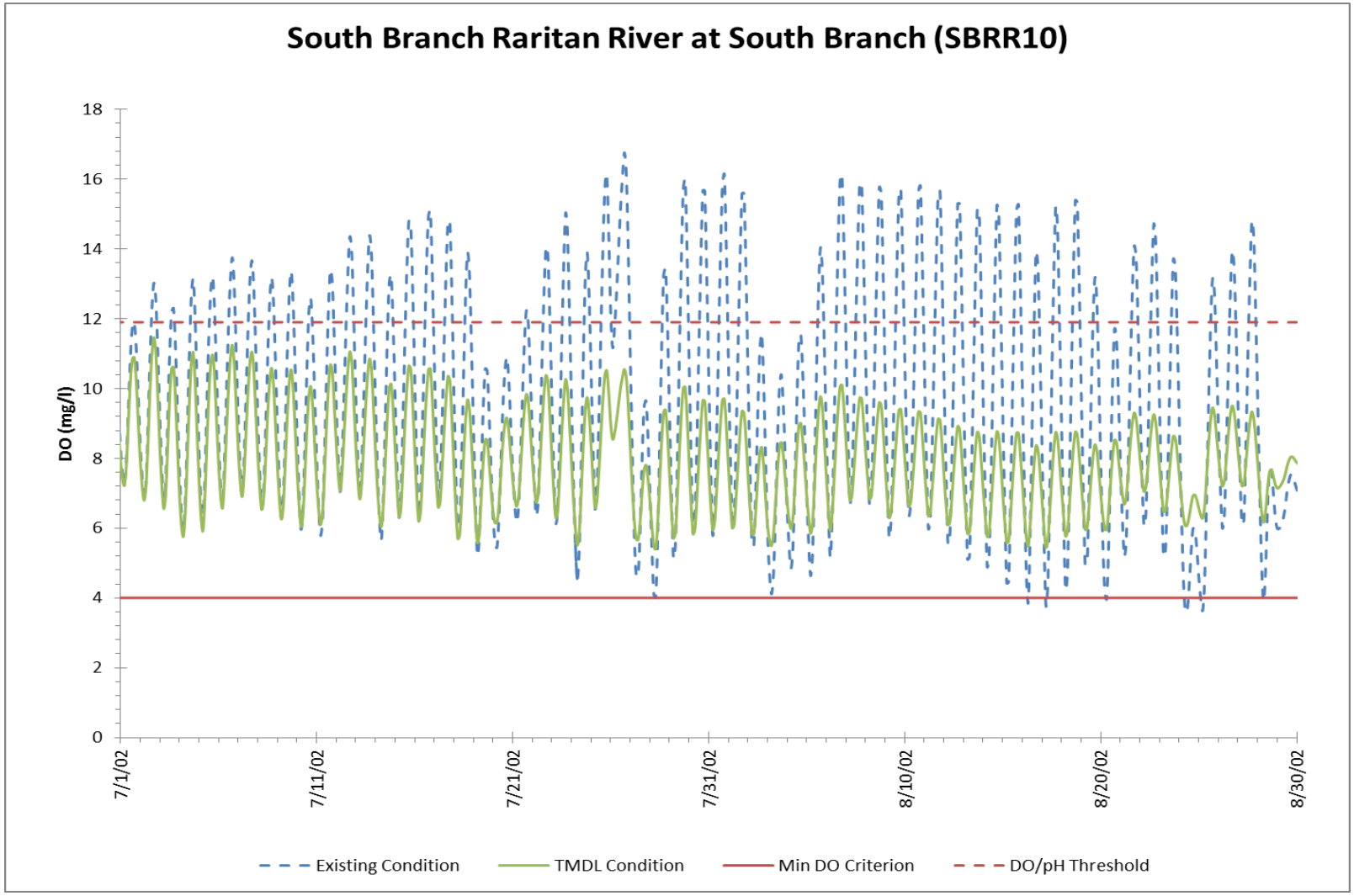
- 80% NPS reduction.
- WWTP WLAs were unable to be variable by season - lakes respond to annual loads.
- WWTP ortho-phosphorus is not a critical factor in model simulation.
- The WWTP model inputs under the TMDL condition range from 0.09 to 0.35 mg/l TP.

Draft TMDL Outcome

Beden Brook Watershed Nutrient Reductions

- 60% NPS reduction.
- Seasonal WWTP WLAs based on summer/winter 7Q10 flows.
- The WWTP model inputs under the TMDL condition range from 0.2 to 1.0 mg/l TP.

Example of TMDL Outcome



Watersheds with deferred TMDLs

- Lower Millstone/Lower Raritan River is deferred for total phosphorus due to uncertainty in predicting eutrophication and the resultant impacts on water quality. Additional monitoring data to be used in a separate river TMDL.

<u>Affects 7 dischargers including:</u>

5 Minor and 2 Major WWTPs

(SRVSA, Stony Brook RSA – River Road)

- Duhernal Lake will be a separate lake TMDL

<u>Affects 2 dischargers including:</u>

1 Major (WMUA - Pine Brook STP) and 1 Minor

NPS implementation plan

- Regulated Stormwater and Nonpoint sources are important to reduce!
- A suite of measures will be needed to achieve NPS reductions including:

MS4 measures, fertilizer law, existing stewardship programs (ex: River Friendly) and targeted future funding (ex: 319 grants, Farm Bill funding, SRF loans)

Comprehensive Water Resource Management in the Raritan Watershed

- The TMDL is a regional solution, promoting equitable distribution of load
- The TMDL calls for coordination and prioritization across the Department, other Agencies and outside partners
- The TMDL is a "smart" action, moving from the scientific study to action
- The TMDL aligns resources with the water related issues in a holistic manner
- The TMDL provides metrics to measure outcomes
- The TMDL is part of the overall action plan for the Raritan, including regulatory and non-regulatory opportunities

Next Steps and Schedule

- [x] Informal meeting with stakeholders

  (WWTP stakeholders invited to discuss facility specifics on June 18th)

- Proposal as an amendment to WQMPs in NJR
- Public hearing
- Respond to comments (revise TMDL report as needed)
- Submit to EPA for approval
- Adopt amendment to WQMPs in NJR
- Implementation through permit modifications and NPS reduction measures
- Finalize report this Fall and adopt January 2014.

THANK YOU

Informal Discussion